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mainly with a view to receiving the time-signals from Paris and Norddeich.

When war broke out and the wireless was dismantled and interned, he applied himself to the sextant, and, with the aid of a ship's chronometer, succeeded in taking surprisingly accurate observations, finding no difficulty in determining the difference in latitude between two points within a garden of less than an acre in extent.

In 1900 he went to Algiers to view the Total Solar Eclipse, and in 1905 to Majorca for the same purpose. His observations of the times of contact and of the appearance of the shadow-bands in the 1900 eclipse are contained in the eclipse volume published by the British Astronomical Association. During last year, owing to depletion of staff at his office, he was assisted by his only daughter, and they were both killed instantaneously in the destruction of the building during the air raid of June 13.

He was elected a Fellow of the Society on 1906 January 12. He was a regular attendant at the meetings, but did not contribute any papers.

John Tebbutt was one of those enthusiastic non-professional astronomers who, with instrumental appliances of the humblest order and no outside help, make an indelible mark on our records. He fortunately wrote an autobiographical account * of his work ten years ago, which is in our library and was widely distributed, but many of the details are so full of interest as to be well worth repetition here.

He was born at Windsor, N.S.W., on 1834 May 25, and spent a long and peaceful life of nearly eighty-three years in that city or in the outskirts till his death in 1916 November. His grandfather, John Tebbutt, a Middlesex man, married Ann Halfpenny in 1788, and emigrated to New South Wales with his wife and three children in 1801. A great flood in 1809 brought hardship and losses on these early settlers: the two sons, Thomas and John, "landed from a small boat on the hill near the middle of the Peninsula Estate, and almost exactly on the spot now occupied by the observatories. . . . A heavy thunderstorm came on at the time, and they dragged the boat ashore, turned it over, and sheltered themselves under it from the storm." But gradually a business was built up, apparently with such success that there are practically no further references to financial troubles in the autobiography. But we may gather from the modesty of the astronomical equipment in the earlier years that resources were not too plentiful.

Mr. Tebbutt records his early educational facilities, which were of the usual classical order, with gratitude; but his own love of mechanism seems to have guided him to study first steam-engines,

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* *Astronomical Memoirs, by John Tebbutt; being a Popular and Complete Account of the Astronomical Work done by him at the Peninsula, Windsor, N.S.W., from the year 1853 to the close of 1907.* Sydney: F. W. White, 1908.

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then clocks, and ultimately the heavens. "It dawned on me that the universe was really mechanism of the highest order, and being, as I have already said, mechanically inclined, I began to turn my attention to celestial mechanism." Thus is the keynote of his long working life struck: celestial physics interested him but little —to use a telescope for looking at spots on the Sun he regarded (in the presence of several witnesses) as "amateurish"; his own instruments were used chiefly to discover and observe comets, and his leisure hours in checking numerically the marvellous accuracy with which they obey mechanical laws. Simon Newcomb has left on record the deep impression made upon himself when he first conceived of the universe as a piece of beautiful mechanism of which future configurations could be predicted from certain data: and there is no question but that so magnificent an idea is in itself sufficient motive for a devoted working life.

In 1853, at the age of nineteen, Mr. Tebbutt purchased a sextant and a copy of Norie's *Epitome of Navigation.* He had also the use of a "grandfather" clock, an "ordinary marine" telescope, and a celestial atlas; and with this equipment he set out to explore the heavens. He verified the Sun's rotation by making sketches of the spots (for this mechanical purpose they were apparently noteworthy), observed the comet of 1853 by aligning it with various stars, and calculated the solar eclipse of 1857, which, however, was unfortunately hidden by clouds. He also calculated the orbit of the 1853 comet from his own star alignments and those of 1858 (Donati) and 1860 III from sextant observations made by himself. The interest aroused by this work led him to search for comets, with immediate and startling success; for on May 13 he found the great comet of 1861, one of the largest in history. The discovery was by no means easy, however. At first the comet was faint and almost motionless, so that it might easily have been a nebula for all the information available. To bring a bright star near it with the sextant extinguished its faint light unless a coloured glass was used: Mr. Tebbutt was driven to compare the suspicious object with the star Lacaille 1316, and then to find the distances of the latter from well-known stars with his sextant. On May 16 the object had not sensibly moved, and he "had almost given up hope of its being a comet": then cloudy weather followed: on May 21 he got a glimpse or two through breaks, and began to hope again, and on May 22 he was sure of a change. He wrote off to the Government Astronomer (Rev. W. Scott), and on May 25 sent a letter to the *Sydney Morning Herald.* Continuing his observations and calculations assiduously he announced in the same paper, under date June 13, that the Earth would be "at no great distance from the extremity of the tail" on June 29: a prediction verified *ex post facto* in the northern hemisphere without any suspicion that it had been made by a young and unknown astronomer on the other side of the globe, cable news not being then available.

In 1861 November Mr. Tebbutt purchased a 3¼-inch telescope (by Jones of Liverpool), with which he observed Encke's Comet in

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1862, and Swift's periodical comet (1862 III), recalling proudly that his observations of the latter were used in the definitive determination of the orbit by Hayn, and that "the Windsor telescope was the smallest employed at the twenty-seven stations from which the comet was observed." Moreover, these same observations led to his discovering one of those rare objects a "new star," though he did not realise it at the time, and his discovery has not yet been given a place in the lists of such objects (*e.g.* Harvard Circular No. 4). There seems, however, to be no room for doubt on the matter. We have already seen how the modesty of his apparatus led him to determine cometary places by stepping from star to star. In observing Swift's Comet on October 4 he stepped in this way from the comet to two stars (Brisbane 5754 and 5799), from them by ring micrometer observations to "a conspicuous star of the 5th magnitude," and on October 9 he connected this latter by sextant observations with θ Scorpii, Altair, Antares, and ϵ Sagittarii, finding its mean place for 1862·0 to be $\alpha = 17^{h}\ 29^{m}\ 2^{s}{\cdot}51$ $\delta = -45^{\circ}\ 23'\ 33''{\cdot}8$. He could not find this star in any catalogues at his command at the time, but this did not surprise him very much. In recurring to the place in 1877, however, he was surprised to find that the only object near the deduced position was a faint telescopic one. The C.P.D. gives no star in the place. It may confidently be said that Mr. Tebbutt was too good an observer to have made any mistake. He described his discovery fully in a paper to the Royal Society of New South Wales in 1877, but it has not been generally recognised. It is remarkable, firstly, as being a consequence of the restricted nature of his resources; for with better equipment he might never have been driven to make use of this intermediary; and secondly, for the fact that this new star should, as it were, obtrude itself on the attention for a useful purpose, as in the case of Nova Geminorum in 1903, which offered itself to Mr Bellamy at Oxford as a guiding star. This particular achievement, however, was not recognised at the time; but the cometary discoveries and work generally were so well appreciated, that in 1862, on the retirement of the Rev. W. Scott, Mr. Tebbutt was offered the post of Government Astronomer. He declined it "for reasons assigned at the time," and continued to work with quite small optical means for another twenty years.

In 1863 he built a small observatory with his own hands, being "carpenter, bricklayer, and slater," in which he installed a 2-inch transit (by Tornaghi of Sydney), a box chronometer, and the 3¼-inch above mentioned. He used the transit both in the meridian for time and in the prime vertical for latitude. In 1872 he added a 4½-inch equatorial, which he bought for £100.

It was not until 1886 that he obtained an instrument which many astronomers would regard as a minimum equipment—an 8-inch Grubb, for which he paid £400; but so great had been his assiduity, that he had by this time (1886) made over sixty communications to this Society and over seventy to the *Astronomische Nachrichten*, besides minor notes. The list of his papers ultimately exceeded

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300. They included observations of the Transit of Venus in 1874 (that in 1882 was cloudy), of various eclipses of the Sun, Moon, and of Jupiter's satellites; of the longitude and latitude of his observatory; of places of various minor planets, and of Neptune, Uranus, Saturn, and Jupiter, by equatorial comparisons with stars, of occultations, of variable stars, in addition to the numerous cometary observations and calculations which formed the staple.

While subsequent years failed to provide discoveries like those of a large comet in 1861 and of a new star in 1862, they brought opportunities for thoroughly useful, if less sensational, work in plenty; but in view of the completeness of the autobiographical account already mentioned, it is perhaps scarcely necessary to give the details here.

In 1904 Mr. Tebbutt decided to retire from systematic astronomical work at the age of seventy, and a cordial message of appreciation was sent him on the occasion by the Royal Society of New South Wales. In 1905 this Society awarded him the Hannah Jackson (*née* Gwilt) Gift. There is no doubt that such recognitions were keenly enjoyed. The visit of a party of English astronomers (including the Astronomer Royal) in 1914, when the British Association met in Australia, was specially welcome. They found the observatory still in excellent working order, and were proudly shown the sextant and other early apparatus which had done such historic work. The journey from Sydney to Windsor was not a serious undertaking for a motor car, but with earlier facilities for transit must have been an effective barrier against frequent visits. Nevertheless Mr. Tebbutt accepted the first Presidency of the Sydney Branch of the British Astronomical Association in 1895, and honourably discharged the duties thus undertaken.

He was elected a Fellow of the Society 1873 January 10.

H. H. T.

William Harold Tingey was born in 1868 at Rochester, where his family had resided for many years, owning cement works, which have now been acquired by a company. He was educated at Brighton College and Trinity Hall, Cambridge, where he studied law, being subsequently called to the Bar; he did not, however, practise as a barrister.

He married about 1892 Miss M. Tovey, daughter of Colonel Tovey, R.E. She survives him with two sons, the elder of whom is a Captain in the R.E. and an expert in wireless telegraphy.

Besides his interest in astronomy, Mr. Tingey followed many other scientific pursuits, and was also well known as an amateur actor.

He died on 1917 August 3 in a nursing home as the result of an operation. He was sincerely respected, and his death is deplored by a large circle of friends.

He was elected a Fellow of the Society on 1899 February 10, and was also a Fellow of the Royal Meteorological Society.